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REPORT OF THE SURVEYS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST -1930-

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-1930-

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REPORT OF THE SURVEYS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FORESTS#
-1930-

INTRODUCTION

One of the aims of this report is to show the status of the infestation on the Beaverhead National Forest from the time surveys were initiated on the greater portion of the area in 1927 up to and including the 1930 season. A second purpose is to show the spread of the epidemic. An attempt will also be made to give an index of the sources of infestation and what each has contributed to the annual and total losses. Furnishing an idea of the distance that beetles can fly is another object of this report.

The purpose of the survey has changed since the 1925 season. Prior to that time the object had been to secure the general location and number of infested trees on each unit with the object of planning control. With the tremendous increase in the number of infested trees in 1926 and the cessation of control work, the original need for the survey was no longer present. Information was meager, however, on advance and development of infestations, so it was decided to continue the annual survey for a number of years as a research project. It was also found necessary in 1930 to include the entire Beaverhead Forest in the survey due to the spread of insects. While the surveys since 1925 have been made with a different object in view, the method used has been the same, so the data secured are comparable.

This report includes the annual progress report of the Big Hole Basin survey supplemented by the additional areas which makes the survey include the entire forest.

HISTORY OF THE INFESTATION IN THE BIG HOLE AREA

In 1925 it was determined by an insect survey that the mountain pine beetle had crossed the Continental Divide from the Bitterroot infestation in Montana and had become established in the lodgepole pine stands of the Big Hole Basin. Control work was instituted in 1926, and 5,271 trees were treated in this region, and 1,244 trees on the adjoining Bitterroot drainage. A heavy flight of beetles in 1926 made it necessary to concentrate all available funds upon the Big Hole Basin in 1927. During that season on the north and west sides of the Basin from the boundary of the Deerlodge-Beaverhead Forests west and south to the Battlefield, 17,546 trees were treated. To facilitate administration of control work the Basin was divided into units, each of which usually embraced the lower part of the watershed of one or more of the larger streams.

An insect reconnaissance made during the fall of 1927 showed that the insects, besides becoming established in even greater numbers in the units in which treatment had been instituted, had spread to the east side of the Basin and into the Fish Trap-Wise River section. The reconnaissance gave an estimate of 67,701 trees in the total area surveyed. In 1928, 55,045 of these trees were treated on these units.

The treating work of 1928 was followed by a large increase in the number of attacked trees, due to invading insects, so great as to make control work no longer practical. The invading insects are thought to have come from both the Idaho and Bitterroot epidemics as well as from local increase from trees not treated on control areas. No control work has been done on the forest since 1928. Efforts have been concentrated since then on watching the nearby Madison Forest to prevent a spread of

the epidemic into that area and eventually into the valuable lodgepole pine stands to the south and east.

It has been previously stated in this report that the area in which control work was conducted had been divided into units to facilitate administration. In deciding the boundaries of the control units, three factors were considered. These were light infestation, limited man-power, and limited funds. These limitations caused the exclusion of the lightly infested areas at higher altitudes and confined the boundaries to the generally heavier infestation at lower elevations. The reports submitted prior to 1930 were on the basis of these limited acreages and consequently included less than the actual amount of infestation. Strip survey was practically confined to these control units until 1929, when sufficient strip was run on the area outside the control unit boundary to warrant computing it on a separate basis. After securing the per cent of increase on the control area from 1926 to 1929, the same rate of increase was used as a basis in computing the unknown number of infested trees outside the area in 1928 from the known number in 1929.

In Table I may be seen the number of infested trees estimated only on the acreage basis of the control units for the year 1927. For 1928 and 1929, estimates of the number of infested trees are given for areas both inside and outside the control units. In 1930 only the revised acreage basis is used.

No change in the number of infested trees for the Bloody Dick and Horse Prairie Units for the original and revised acreages is shown for 1928. It is believed the number of infested trees shown would not have

varied materially with the increase acreage as the area excluded in the original estimate had practically no infestation in 1928. The differences which are shown in 1929 are due to the spread of the epidemic.

...SURVEY - 1930
...OLE PINE
...and present basis of estimate

...e I

Basis Attacked 1930 Present(5)	Attacked 1927	Trees Per Acre 1928 Within Control Unit Boundary	1928 Outside Control Unit Boundary	1928 Average of Both	1929 Within Control Unit Boundary	1929 Outside Control Unit Boundary	1929 Average of Both	1930(5)	Per cent of increase in number of attacks over previous year(4) 1928	1929	1930
440,403	0.780*	0.340	0.315	.500	7.491	2.807	4.462	7.150	8	792	60
508,483	0.959*	2.140	0.533	1.118	8.921	2.225	4.661	9.033	123	317	93
1,006,586	0.193*	0.770	0.233	.428	8.219	2.490	4.567	9.830	299	967	115
457,655	0.147*	0.670	0.176	.391	4.718	1.238	2.752	5.982	355	604	117
504,449	0.110*	0.860	0.279	.495	4.425	1.438	2.548	6.655	682	415	161
245,724	0.100	0.479	0.273	.273	1.545	1.545	1.545	2.271	380	467	47
34,200	0.240	0.479	0.205	.205	2.644	2.644	2.644	0.600	100	1192	-77
7,990	-	0.054	0.054	.054	0.216	.216	.216	0.117	-	298	-46
11,900	0.013	0.013	0.013	.013	0.077	.077	.077	0.280	0	493	264
113,277	0.020	0.370	0.370	.370	1.593	1.593	1.593	2.078	1750	331	30
415,172	0.608*	0.659	0.073	.408	3.939	0.434	2.438	4.816	8	497	98
24,463	0.015	0.066	0.066	.066	0.118	0.118	.118	0.171	340	79	45
65,556	0.068*	0.013	0.013	.013	0.440	0.440	.440	1.111	51	327	153
10,368	-	-	-	-	-	-	-	0.078	-	-	-
12,959	-	-	-	-	0.068	0.068	.068	0.059	-	-	-12
3,835,958(7)	0.163(8)	0.400(7)	.192(7)	.321(7)	1.714(11)	1.748(11)	1.724(11)	3.839(7)	140(7)	553(7)	84(10)
3,859,276	0.075(9)						2.086(7)	2.876(10)			

(6) Exclusive of Lima Unit.
(7) Exclusive of Lima and Melrose Units.
(8) Including 55,045 trees treated in 1928.
(9) Infestation remaining after treating 55,045 trees.
(10) Includes Melrose and Lima Units.
(11) Includes Lima Unit.

SUMMARY SHEET - [illegible]
MOUNTAIN PINE [illegible]
Comparison of acreages and infestation

Total Number of Infested Trees on Former and Present acreage
Given for the year in which

Name of Unit	Acreage Estimate of Each Unit Former	Present	1927(1) Former	1928 Former	1928 Present(2)	1929 Former	1929 Present(3)
Pintlar	21,760	61,600	16,967*	18,278	30,815	163,004	274,834
Mussigbrod	20,480	56,300	19,647*	43,827	62,940	182,702	262,402
Battlefield	37,120	102,400	7,166*	28,582	43,816	305,089	467,636
West Side	33,280	76,500	4,904*	22,297	29,697	157,015	210,521
Jackson	28,160	75,800	3,097*	24,217	37,519	124,608	193,114
Bloody Dick	61,440	108,160	6,144	29,491	29,491	94,895	167,107
Horse Prairie	24,320	57,000	5,836	11,673	11,673	64,323	150,765
Rattlesnake	48,000	68,400	-	2,592	3,694	10,347	14,706
Grasshopper	41,600	42,500	540	540	552	3,224	3,273
Warm Springs	51,200	54,500	1,024	18,944	20,165	81,551	86,819
East Side	49,280	86,200	29,980*	32,524	35,208	194,113	210,136
Upper Wise River	144,000	142,800	2,160	9,504	9,425	16,929	16,850
Lower Wise River	61,440	59,000	4,181*	6,328	6,077	27,024	25,960
Melrose	132,700	132,700	-	-	-	-	-
Lima	218,000	218,000	-	-	-	14,750	14,750
Totals or averages	622,080(7)	999,160(7)	101,646(8)	248,797	321,272	1,424,824(6)	2,084,123(6)
	972,780(10)	1,341,860(10)				1,439,574	2,098,873

* Includes trees treated in 1928.

(1) No figures are given for the entire unit in 1927 due to lack of data. Any estimate from 1928 figures would be subject to too great an error.

(2) Estimated from 1929 data on basis of 1929 increase outside of the control units being the same as that within.

(3) Contains total estimate for unit, both within and outside the control unit boundaries.

(4) No comparison is given prior to 1928 as no general survey had been made before that time.

(5) No separation of the data for areas within and outside of the former control areas was attempted in 193[illegible]. Only the increased acreage was used as a basis for computing infestation.

As Table I indicates, the revised acreage basis for each unit usually exceeds that of the old control units. In consequence, the number of infested trees per unit on the revised basis is usually in excess of the previous estimates. The changes in area and attacked trees per unit also changes the per cent of increase of infestation over the entire forest. Most of the heavily infested units had large additions to both their acreage and number of attacked trees, while the more recently added and less heavily infested units had little or no change. It is these changes that account for the difference in figures given in the present and preceding reports.

While the per cent of gain in infestation was much less in 1930 than in 1929, a tabulation of attacked trees and of actual per cent increases should give a clearer conception of the situation. The tabulation follows:

INCREASE IN MOUNTAIN PINE BEETLE INFESTATION
BEAVERHEAD NATIONAL FOREST

Infestation in	1927	1928	1929	1930
	101,646 (1)	248,797 (1) 321,272 (2)	2,084,123 (2) 2,096,873 (3)	3,859,276 (3)
Increase	1928 over 1927	1929 over 1928	1930 over 1929	
In No. of infested trees	147,151	1,762,851	1,760,403	
In per cent	140	553	84	

(1) Based on original acreage estimate.
(2) Based on revised acreage estimate.
(3) Including Melrose and Lima Units.

From the preceding tabulation it may be seen that while the per cent of gain in 1930 was somewhat less than one-seventh of what it was

the previous year, the actual number of infested trees was practically the same.

In an effort to show the main sources of the infestation on the Beaverhead Forest during the period of this project, the data have been divided into three groups. While this division may be subject to considerable error, there seem to be logical groups into which the units can be placed on the basis of their source of infestation. In one group may be included the units adjacent to the Bitterroot epidemic and subject to infestation from that source, in a second set are the units adjacent to Idaho and subject to overflow of insects from the vast infestation in that state, and in the last may be grouped those units fairly remote from both of these areas and which probably owe the major part of their infestation to the migration of beetles from adjoining or nearby units. The boundaries of these groups are shown on the appended map.

In the first group, subject to the infestation from the Bitterroot epidemic, are placed Pintlar, Wissigbrod, Battlefield, East Side, and Lower Wise River units. Those likely to receive their infestation from migrating Idaho insects are the West Side, Jackson, Bloody Dick, Horse Prairie and Lima units. Areas fairly remote from both of these sources are the Rattlesnake, Grasshopper, Upper Wise River, Warm Springs and Melrose units. Data were not secured for the Rattlesnake Unit prior to 1925, nor for the Lima Unit before 1929, nor for the Melrose Unit until 1930. By grouping of the unit data on the actual acreage basis, we find that in Group I in 1927 the Bitterroot source of infestation apparently caused most of the increase in the epidemic. To facilitate comparison, Table II, supplemented by Chart I, is arranged to show the infestation in the three groups for the period of the project. However, before presenting the tabulation, we must again point

out that there are no direct data to support this division. The basis of this division is only what seems to be a logical supposition. If correct, the table gives the portion of the infestation that can be credited to each source.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST FROM 1927 TO 1930 ARRANGED ACCORDING TO SOURCE OF INFESTATION

Table II

Estimated Attacked Trees from each source shown in their relationship to the Total Infestation for that year

	Bitterroot Drift	Idaho Drift	Local Increase	Total
1927 (1)				
Infested Trees	77,941	19,981	3,724	101,646
Per Cent of Entire Infestation	76.7	19.6	3.7	100
1928				
Infested Trees	178,856	108,580	33,836	321,272
Per Cent of Entire Infestation	55.7	33.8	10.5	100
1929				
Infested Trees	1,240,968	736,257	121,648	2,098,873
Per Cent of Entire Infestation	59.1	35.1	5.8	100
1930				
Infested Trees	2,436,300	1,254,978	167,998	3,859,276
Per Cent of Entire Infestation	63.1	32.5	4.4	100
Total Trees Killed 1927-30	3,934,065	2,119,796	327,206	6,381,127
Per Cent of Entire Infestation 1927-30	61.7	33.2	5.1	100

(1) Does not include an estimate of the trees attacked outside of the control units.

It may be seen from Table II and Chart I that the Bitterroot infestation seems to have played the dominant part in causing the epidemic on the Beaverhead Forest. Again, if the figures shown in Table II represent the true conditions, about 62% of the Beaverhead infestation owes its origin to the Bitterroot epidemic. Based on the same supposition, the Idaho outbreak was the source of about 33% and local increase caused a little more than 5% of the infestation.

The magnitude of the losses on the Beaverhead may be seen from the total figure of 6,381,127 trees killed from 1927 to 1930. The annual loss is shown graphically in Chart II.

To give an idea of the status and increase in infestation for the period from 1927 to 1930 from each source, within the area affected by them, Table III has been prepared. Attention is again directed to the possibility of a large error in this arbitrary arrangement of the data.

STATUS OF THE MOUNTAIN PINE BEETLE INFESTATION ON THE BEAVERHEAD NATIONAL FOREST FOR THE PERIOD FROM 1927 TO 1930 ARRANGED ACCORDING TO SOURCES

Table III

Each Group Considered Separately Showing Increase in Attacks.

Infested Trees	1927	1928	1929	1930	1927-30
From the Bitterroot Epidemic					
Number	77,941	178,856	1,240,968	2,436,300	3,934,065
Increase over previous	-	100,915	1,062,112	1,195,332	-
Per year	-	77.2	593.8	96.3	-
From the Idaho Infestation					
Number	19,981	108,580	736,257	1,254,976	2,098,873
Increase over previous	-	88,599	627,677	518,721	-
Per year	-	443.4	578.1	70.5	-
From Local Increase					
Number	3,724	33,836	121,648	167,998	327,266
Increase over previous	-	30,112	87,812	46,350	-
Per year	-	808.6	259.5	38.1	-
Total Each Year	101,646	321,272	2,098,873	3,859,276	6,381,127
Per cent of the loss for period 1927-30	1.6	5.0	32.9	60.5	100

An inspection of Table III and Chart I indicates that the migration from the Bitterroot infestation caused great increases from 1928 up to the present time, with the 1930 attacked trees numerous but not showing the same proportion of increase as occurred the two previous years.

The Idaho epidemic seems to have been the cause of a heavy loss on some units in 1928, of a very heavy loss in these units in 1929, but of apparently considerably less loss in these units in 1930. The slighter losses in 1930 would indicate that either very few insects flew in from Idaho or else a heavy mortality occurred locally and a moderate migration came in from that source. The apparent reduction in the number of insects coming from Idaho makes the future influence of that source of infestation problematical. General observations made during the 1930 field season indicate that a very heavy mortality did occur in 1929-30 to the overwintering brood of the mountain pine beetle in the Big Hole Basin. Possibly the same thing happened in Idaho and to a lesser extent on the East Fork of the Bitterroot River.

Further inspection of Table III indicates that local increases in 1928 in the units remote from the Idaho and Bitterroot sources, were very heavy. It is believed, however, that insects migrating into some of those areas that year from one of the main sources, may have caused much of this increase--chiefly on the Warm Springs Unit. Furthermore, the addition of the Rattlesnake Unit data in 1928 also raised the figure for that year materially. The data for 1929 on the number of attacked trees caused by the local increase, indicate a big gain over the previous year, but show less than half the per cent of the gain that was found on the units exposed to the Bitterroot and Idaho outbreaks. The 1930 local increase was but little more than half the amount that occurred in 1929.

It is felt that although beetles from both the Idaho and Bitterroot infestations may continue to fly into the Beaverhead Forest for a number of years, the Beaverhead infestation is rapidly approaching the status where these incoming insects will be but a minor proportion of the entire infestation in that region. The local conditions influencing brood development on the Beaverhead Forest should become increasingly important as the epidemic assumes more and more the character of a local and independent infestation. Already the impetus given to the Beaverhead outbreak by invading insects has progressed to the point where the losses caused by them are equal, if not greater than the losses they will cause on the area in the future.

To aid in visualizing the conditions that have resulted from the presence of the infestation on the Beaverhead Forest from 1927 to 1930, Table IV has been prepared, giving the total number of trees killed per acre on the different units during that period.

TREES KILLED PER ACRE ON EACH UNIT BY THE MOUNTAIN PINE BEETLE
PERIOD 1927 TO 1930
BEAVERHEAD NATIONAL FOREST

Table IV

Unit	Trees Killed per Acre 1927-1930	Unit	Trees Killed per Acre 1927-1930
Pintler	12.892	Grasshopper	.383
Muscigbrod	15.771	Warm Springs	4.061
Battlefield	15.018	East Side	8.270
West Side	9.272	Upper Wise River	.370
Jackson	9.808	Lower Wise River	1.632
Bloody Dick	4.189	Melrose	.078
Horse Prairie	3.689	Lima	.127
Rattlesnake	.387		
		Average loss over entire forest	4.755

STATUS OF THE INFESTATION ON EACH UNIT

The more detailed discussion following, and the appended map should aid in a clearer understanding of conditions on each unit.

Pintlar Unit

Pintlar Unit showed only a moderate increase in the number of attacked trees in 1930 over the previous year. Two factors are believed to be chiefly responsible for this slight gain. The heavy infestation already present on the area prevents any but an extremely heavy inflow of beetles from influencing the annual number of trees attacked. The second major factor is the increasing remoteness of the Pintlar Unit from the most active part of the Bitterroot infestation. This infestation in its southwestward spread is now abreast of the Battlefield Unit. Though at present, a minor source of infestation for the Pintlar and Mussigbrod Units exists on the south branch of the East Fork of the Bitterroot River, the influence it may have on the outbreak on these units is uncertain.

Mussigbrod Unit

From Table I it may be seen that the Mussigbrod Unit showed a greater increase in attacked trees in 1930 than the Pintlar Unit. Located as it was nearer the Bitterroot infestation, it is believed to have received a somewhat larger inflow of beetles from that source than the more remote Pintlar Unit. Total losses to date have been higher per unit of area on the Mussigbrod Unit than on any other area of the Beaverhead Forest; probably because that unit received a large part of the overflow from the Bitterroot infestation up to 1929.

Battlefield Unit

The Battlefield Unit showed the largest total gain in number of attacked trees in 1930 of any area on the forest. About 31% of the total

increase on the entire forest for 1930 occurred on this unit. This is believed to be due to the advancing Bitterroot infestation overflowing into it. It is thought that the Battlefield Unit will receive the greater part of the beetles migrating from the Bitterroot into the Big Hole Basin for a number of years. With its heavy stand of susceptible timber, and the Bitterroot infestation spreading into it, this unit will probably show the heaviest losses of any area on the forest.

The trees killed by insects on the preceding three units, up to the present time, have amounted to practically one-half the total killed on the Beaverhead Forest, although their area is only about one-sixth of the total acreage.

West Side Unit

Adjoining the Battlefield Unit on the south is the West Side Unit. The gain in infestation on this area was quite heavy in 1930, indicating either that there was considerable migration from the Idaho outbreak adjoining it, that a low mortality occurred locally, or that a combination of both these possibilities may be responsible for the large increase.

It may be thought that the approaching Bitterroot epidemic contributed heavily in 1930 to the infestation on the west side of the Big Hole Basin south of the Battlefield Unit. Had that been the case, it seems probable that the unit nearer to that source would show the largest number of attacked trees and per cent of increase. However, it is the more remote Jackson Unit that shows the greatest increase, indicating that the Bitterroot epidemic added little if any to the gain, but that the heavily infested timber in Idaho adjoining these areas were probably the largest contributors.

Jackson and Bloody Dick Units

It is believed both the Jackson and Bloody Dick Units have the same status as the West Side area. All three have fairly heavy stands of timber. Also the Idaho epidemic is thought to have been the common and chief source of invading insects into these three areas. The gain on these three units, attributed chiefly to Idaho migration, from 96,907 in 1928 to 570,742 in 1929, amounted to 473,835 trees or an increase of 489%. The 1,207,828 attacked trees of 1930 exceeded the total of the previous year by 637,000, or a gain of about 112%. If the figures for the two years are indicative, that part of the Idaho infestation adjacent to these three units, yielded more invading insects in 1930 than in 1929.

Horse Prairie Unit

The Horse Prairie Unit has a more patchy type of timber than the neighboring Bloody Dick Unit to the north, and a larger proportion of timber unmusceptible to mountain pine beetle attacks is also present on the Horse Prairie area than on any of the other units so far discussed. The foregoing conditions together with the probably high mortality of insects already present on the area, to little if any invasion by insects from Idaho, or a combination of all these factors, are thought to be responsible for the reduction in infestation on this unit in 1930.

Lima Unit

The Lima Unit, with only about 32,000 of its 218,000 acres timbered, also showed a reduction in infestation in 1930. It seems unlikely that the Lima Unit can ever carry a great amount of infestation by Dendroctonus monticolae. Beside having the timber in open, scattered patches, there is a high proportion of tree species not attacked by the mountain pine beetle. Only a few small isolated areas of pure lodgepole pine exist in

this division of the forest.

Rattlesnake Unit

The Rattlesnake Unit also has a considerable proportion of unsusceptible timber, but it has many extensive areas of lodgepole pine. Remoteness from heavily infested areas is thought to have been responsible for the sub-average increase in 1929 and the decided decrease in infestation on this unit in 1930. The outbreak on this area is fairly light and the total losses to date have averaged less than one-half a tree per acre.

Melrose Unit

The Melrose Unit is fairly similar in stand character to the Rattlesnake Unit, differing only in having more extensive stands of pure lodgepole, and a smaller proportion of unsusceptible species. Like the Rattlesnake Unit, it has been favored by isolation up to the present time, and the destruction by the beetles amounts to less than a tenth of a tree per acre. Both the Lima and Melrose Units were added to the survey in 1930.

Grasshopper Unit

The Grasshopper Unit showed the largest per cent of gain in 1930 of any area on the forest. The 1929 infestation on that area was very light and the influx of only enough beetles to infest a few thousand trees was necessary to make the 1930 gain outstanding. Such a migration probably occurred, with the adjacent heavily infested Warm Springs Unit the most likely source. There are some extensive areas of mature lodgepole pine on the Grasshopper district, and the proportion of species not subject to mountain pine beetle attack is comparatively low. These conditions favor an increase in losses in the future.

Upper Wise River Unit

The Upper Wise River Unit showed a very nominal increase in 1930 over 1929. The outbreak on this unit is still very light, with the total

losses up to the current year of less than one-half tree per acre. The infestation of this unit probably had its source in the adjoining units on the north and west.

Warm Springs Unit

The Warm Springs Unit received a heavy impetus to its infestation in 1928, probably by migration of insects from the adjoining East Side Unit or even from the Idaho or Bitterroot epidemics. The 1929 gain was below the average and was most likely due only to local increase in the considerable stands of susceptible timber that occur on this area, and which would greatly facilitate multiplication of the insect. The gain in attacked trees in 1930 was also below the average for the forest.

East Side Unit

The Bitterroot infestation was the probable source of the large gains in numbers of attacked trees on the East Side Unit from 1927 to 1930. In spite of greater remoteness from the above source than the Pintler, Mussigbrod, and Battlefield Units, the gain in infestation on the East Side district averaged about the same in 1930 as for those three units. The total losses on the area have been not only the heaviest of any on the east side of the Big Hole Basin, but are in excess of the total losses suffered by the remaining units on the east side of the forest. A great deal of mature lodgepole pine has made the East Side Unit an excellent feeding ground for the beetles.

Lower Wise River Unit

The Lower Wise River Unit showed the third highest per cent of gain of any area in 1930. However, conditions on this unit are quite similar to the Grasshopper Unit, where the influx of a comparatively few beetles on an area of light infestation makes a tremendous gain in per cent of increase. The sources of gain in attacked trees for the Lower Wise River Unit

were probably the Bitterroot infestation and the East Side Unit.

MOUNTAIN PINE BEETLE FLIGHT

One of the objects of the annual Beaverhead Survey is to gain some idea of the ability of the mountain pine beetle to make long and sustained flights. An example of this ability was noted on an isolated area of lodgepole pine about ten miles south of Dillon, on the drainage of Sheep Creek, a tributary to Blacktail Creek. This area showed approximately 10,000 trees attacked in 1929. The small number of 1928 attacked trees were considered insufficient to account for the increase in 1929, the light infestation already present probably being augmented from another source, of which the nearest of any consequence was the lightly-infested Lima Unit. From this discussion, the logical conclusion is that the insects infesting the Sheep Creek Area flew at least 25 miles.

The rise from 10,000 attacked trees on the Sheep Creek District in 1929 to 11,500 in 1930 seems quite likely to have been a local one.

DATA CONCERNING ADMINISTRATION OF THE SURVEY

While the per cent of area covered by the 1930 survey is less than that of 1929, the acreage reported in the 1930 survey was more than twice that of 1929. The actual mileage of sample strip traversed in 1930 considerably exceeded that of the previous year, though the average mileage per day was less than in 1929. The heavier infestation, requiring more counting and more frequent entries of data, was responsible for part of this lowering of daily mileage. In addition the unusual ability of one member of the 1929 survey crew to cover long distances in a day helped make the average for that year abnormally high. Any increase or scattering

of the infestation will probably continue to lower the daily average of strip mileage with each succeeding year, because of the necessity for, and the delays because of more frequent entries of data.

The personnel engaged on the 1930 survey and the time each was engaged on the project is shown in the following tabulation.

Name	Man-Days
Gibson	59 & 30 (office time)
Miller	46
Foley	47
Bedard	30
Rust	8
Lopp	5
	195 & 30 = 225

SUMMARY

The outstanding findings of the 1930 survey were as follows:

(1) An increase from 2,098,873 infested trees in 1929 to 3,859,276 in 1930.

(2) A reduction in the per cent of increase from 553 in 1929 to 84 in 1930.

(3) An apparent continued heavy drift of insects from the Bitterroot infestation into the Big Hole area.

(4) An apparent reduction of drift of insects from the Idaho infestation.

(5) An apparent heavy mortality in insects overwintering during the 1929-1930 season.

(6) Observation of the extension of the infestation to all parts of the Beaverhead National Forest.

(7) Evidence of the flight of the mountain pine beetle over untimbered country to infest an isolated area of lodgepole pine at least 25 miles from the nearest infestation.

A tabulated summary and analysis of results and cost of the survey are given in Table VI.

SUMMARY AND ANALYSIS OF RESULTS AND COSTS
BEAVERHEAD NATIONAL FOREST SURVEY - 1930

Table VI

Items	Total	Man-days on Project: Effective field	Office	Ineffective	Total
Man-days spent on survey	225	144(1)	30	51(2)	225
Miles of sample strip	1164.5				
Miles of strip per man-day		8.7			5.2
No.of sample strip acres	9316.9				
No.of sample strip acres per man-day		69.5			41.4
Acres covered by survey	1,341,860				
Acres covered per man-day		8828			5984

Total Cost of Survey	
Labor	$1269.21
Transportation	256.16
Subsistence	445.33
Equipment	-
Rental of quarters	40.00
	$2010.70

Cost of Survey Distributed	
Cost per man-day	$8.94
Cost per mile of strip	1.73
Cost per sample acre	.216
Cost per acre of region surveyed	.0015
Percent of total area actually covered	.69
Total meals in camp	328
Total cost of meals in camp	$117.23
Cost per meal	.358

(1) 111 man-days spent in running strip exclusive of Lima Unit.
10 " " " " mapping infestation along continental divide.
11 " " " " running strip on Lima Unit.
12 " " " " scouting on Lima Unit.

(2) 30 man-days due to sickness, inclement weather, travel on project etc.
21 pro rated against project for travel time to and from project.

Respectfully submitted,

Archie L. Gibson, Assistant Entomologist.

Chart I

STATUS OF MOUNTAIN PINE BEETLE INFESTATION ON BEAVERHEAD NATIONAL FOREST
ARRANGED ACCORDING TO SOURCES OF INFESTATION
PERIOD 1927 TO 1930

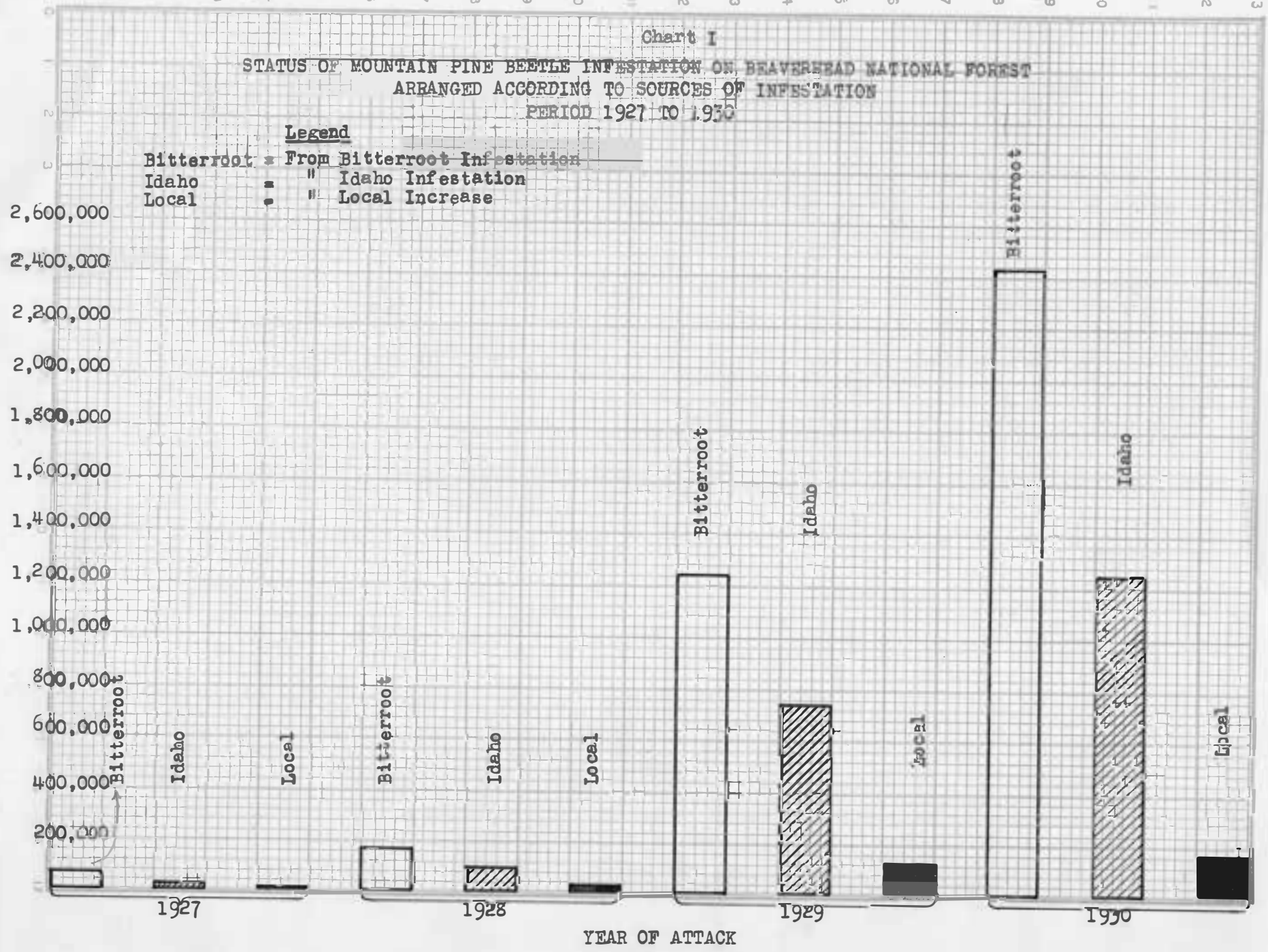
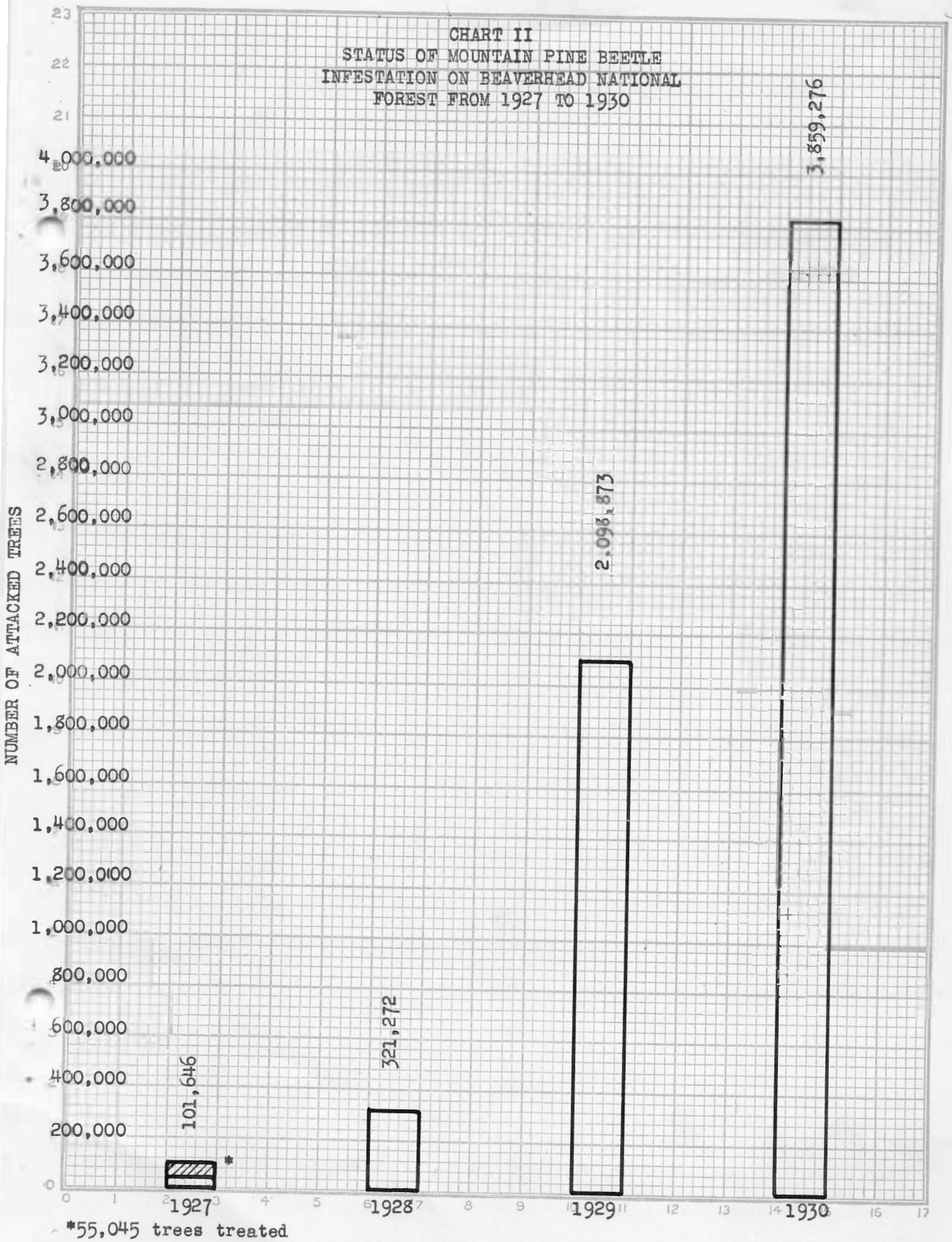


CHART II
STATUS OF MOUNTAIN PINE BEETLE INFESTATION ON BEAVERHEAD NATIONAL FOREST FROM 1927 TO 1930



*55,045 trees treated